IoT Based Blockchain Temperature Monitoring and Fake Medicine Prevention

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ABSTRACT

The Target of today's healthcare system is delivering medicine directly from the manufacturer to end-user. The pharmaceutical supply chain involves distributors, manufacturers, wholesalers, and customers. The biggest challenge related to this supply chain is temperature monitoring also as counterfeit drug prevention. Many drugs and vaccines remain viable within a selected range of temperatures. If exposed beyond this temperature range, the drugs do not work as intended. Many of the world's top-selling medicines are sensitive and need cold-chain shipping, i.e., storing goods during a temperature-controlled environment. Keeping the drugs cold is an important a part of the availability chain that connects drug producers to patients. But storing the essential information associated with cold-chain shipping in centralized databases is often susceptible to manipulations or data hacks. Also, the present software doesn't have tracking capability of maintaining a full chain of identity. One of the most reliable solutions would be the integration of IoT sensors with blockchain. To store the essential information related to cold-chain shipping in a blockchain network so, it becomes impossible for the data to get manipulate by anyone unlike centralized databases.

Keywords: Pharmaceutical supply chain, Cold-chain shipping, Blockchain, Temperature-controlled environment.

1. Introduction

The demand for transparency is growing, but surprisingly, we know very little about most of the products we use in our daily lives. Products are always on the big network of participants before reaching the final buyer including sellers, distributors, transporters, warehouses, and suppliers involved in manfactures, production, delivery, and sales, etc., still in almost all cases this journey remains unseenConsumer and government demands are increasing to increase transparency from brands, manufacturers and producers throughout the supply chain. This leads to an increase in the demand for manufacturers to provide complete information about their products and their origins. Most of the Pharmaceutical Companies use IoT technologies RFID and wireless sensor-based networks in the supply chain for traceability and visibility [1]-[2].

IoT technology is controlled by a centralized system that develops data reliability and integrity issues, so bribes to administrators can reduce valuable information. Another major challenge is that many drugs must remain active or only work within a certain temperature range. When the temperature is too high or too low, these drugs do not work, thus not working as intended. You can check the temperature conditions, the accuracy of medication allows professional Doctors or convalescent to dispose of obsolete or obsolete medicines. Once you find the right drug, you need to closely monitor the drug's supply chain. determine the suitability of the drug and any heat-sensitive ingredients. Patients, pharmacists, hospitals all rely on a range of pharmaceutical Supply chains and companies that provide heat-resistant medicines such as vaccines and insulin.When transporting these drugs thousands of miles, a smart transport box is needed to maintain the temperature and record all changes in the pre-programmed sensor [3]. The system of transporting and storing medicines from the manufacturer to the customer at a specific temperature is called cold chain management. The key elements of the cold chain are: Equipment for transporting and storing vaccines and equipment for monitoring vaccine temperature. Integrating all types of blockchain technology should be seen as a powerful solution, as trust is required between all supply chain or cold chain participants and

stakeholders. Blockchain technology can store and manipulate all sensor data [4]. Therefore, using blockchain creates trust in an intelligent digital health ecosystem. All important information about how medicines are entered and navigate the supply chain is available to everyone connected to the blockchain system [5]. Therefore, the combination of Block chain and IoT has the potential to be an efficient solution for traceability in supply chain management. Collect information using IoT devices such as sensors and securely store the information collected using Block chain without worrying about data integrity.

2. Problem and Proposed model

The problem is the lack of end visibility, security, trust and follow-up in the current supply chain. The characters involved in the supply chain cannot fully verify the authenticity of the drug and thus the patient is ultimately the victim of any flawed or counterfeit drug being given. Our vision is to bring all these aspects to the supply chain using the benefits provided by blockchain and IoT. Blockchain will provide secure services among program participants and thus ensure the security and prevention of false or misleading transactions between them, while IoT can help ensure the authenticity of drugs that will increase trust among participants. It can also track the temperature in the surrounding tree area and track the tree area that can connect the physical flow and information of the supply chain making the entire order traceable and secure. As all transactions are included in the distributed directory. Since every node in the blockchain stores a transaction report, it is possible to identify the source of the drug, supplier or owner or manufacturer and vendor immediately

2.1. Existing System

With this proposed model, the manufacturer will be able to upload information associated with the drug, after which it will be submitted for approval to the Government. Thereafter, hospitals and pharmacies, depending on their needs, may request approved medications. In the future, if a patient needs certain medications, he or she should request them on a blockchain network. The application will be sent to the nearest hospital or pharmacy and after that, the patient can collect the medication. To use this model, we have used the Hyperledger fabric due to the presence of many automated features in it. Our use of the proposed blockchain-based model highlights that the model can successfully detect any counterfeit drug. This will be useful for users affected by counterfeit drugs. In addition, with the proposed model, we can also track the movement of a drug from the manufacturer to the patient taking the drug.

Disadvantages of Existing System

(1) Pointed out the issues related with privacy and security associated with data sharing and storing.

(2) They also highlighted various issues such as technical problems on implementing this and shared some insights for solving them.

(3) Briefly talked about medical supply chain and highlighted various issues that are making supply chain worse.

2.2. Proposed System

As pharmaceutical medicine moves through the supply chain and needs trust from all parties concerned, we integrate blockchain technology, due to the area allotted to the blockchain surroundings, build trust within the

digital system. The papered framework uses a QR detector and QR scanner that permit the testing of all device information to observe temperature and packets QR code data. If the temperature is exceeded or if the QR code information is modified within the packaging, the system cannot accept packets. The QR code utilized in the model is trendy, clone-proof and secure.

The blockchain stores all the items of data generated by the sensors and QR code readers. Within the event that a bunch of organizations desire to stay info confidential to alternative organizations, the papered model uses Hyperledger. Hyperledger uses totally different channels wherever transactions (ledger) for one channel are personal and hidden in another channel. Within the papered system, it's simple to prove at any time that drug packets or device information weren't used. We've used digital signature schemes to guard sensor information. In our paper we add all vaccines information, manufacturer details in QR code and this information is kept in blockchain. If the user scans the QR code exploitation mobile or uploading a file on the server, it will get the temperature vary. If the temperature is below the brink value its quality is prepared to be used otherwise it's unusable.

Build a quick and advanced blockchain distribution network for high-density IoT devices. Building a web of Things (IoT) and blockchain-based provide chain management.

Advantages of Proposed System

(1) One of the advantages of blockchain technology is the inability to change any contracts and transactions that are added to the ledger.

(2) The advantages associated with applying blockchain technologies, as well as the related challenges.

(3) They proposed a new framework and implementation for detecting Counterfeit Pharmaceutical product systems using Ethereum Blockchain.

(4) Blockchain provides a great security mechanism for the supply chain industry and data immutability is one of the biggest advantages of this platform.

(5) The main goal of the research is to protect the health of each person by taking advantage of the technical characteristics of Blockchain such as Immutability and decentralization.

3. Results and Discussions

3.1. Results

The data which is acquired from the temperature sensor which has been interfaced to Node MCU via Arduino Software has been stored in the blockchain with a series of steps. Upon installing the Anaconda Software several plugins are installed and by creating a folder which encompasses the paper we specify the needed parameters and thus by interfacing with our prototype for a fixed amount of time, continuously, the temperature data gets updated in blockchain for which the private key has been generated. Also using HTML and CSS a web page has been made to provide interface for the manufacturer and end user where the entry and acquisition of the temperature data has been done, below figure represents the flow of this paper.
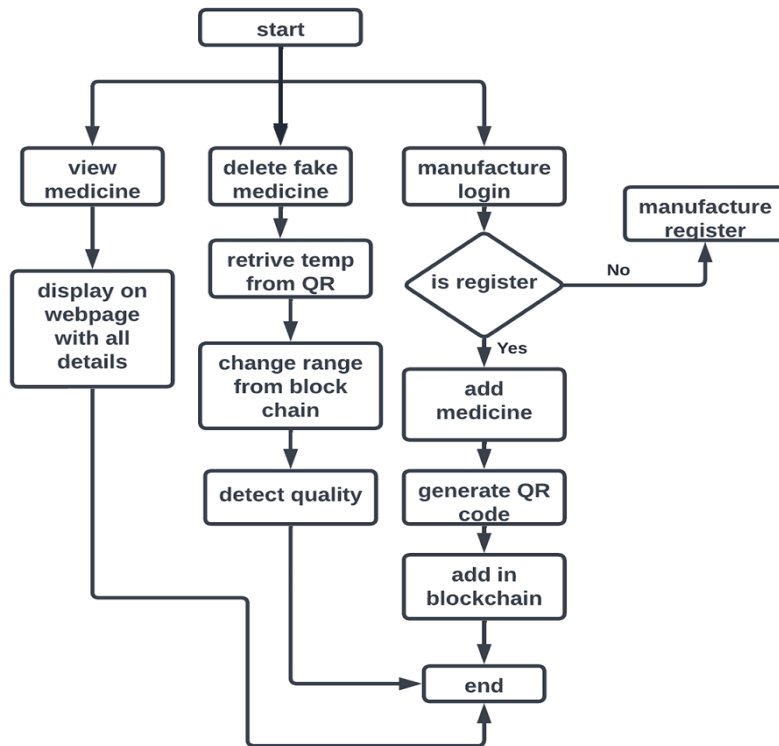
Fig.1. Flowchart of Proposed methodology
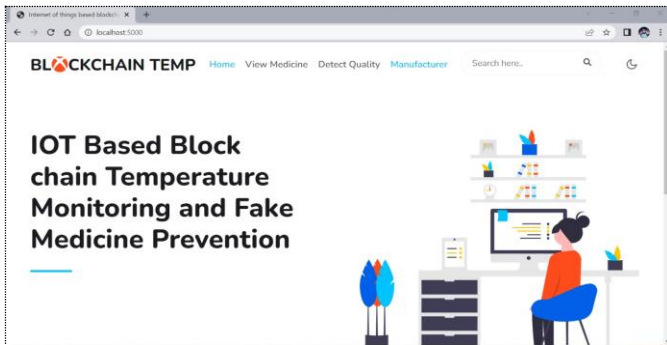
3.2. Outcomes & Discussions

Fig.2. Home Page

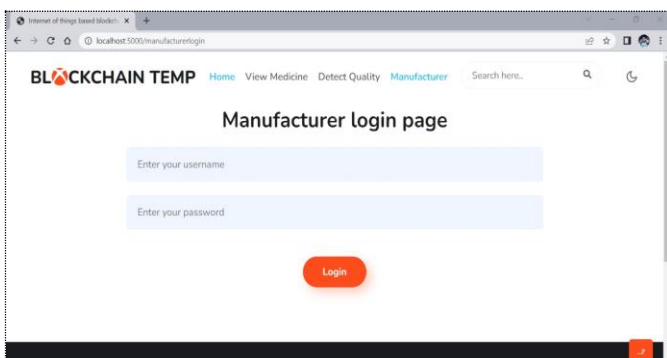Above is the website made for the end user and the manufacturer.

Fig.3. Manufacture Login Page

The manufacturer login page where manufacturer can upload the data of the vaccine with a certain credentials only, he possesses.
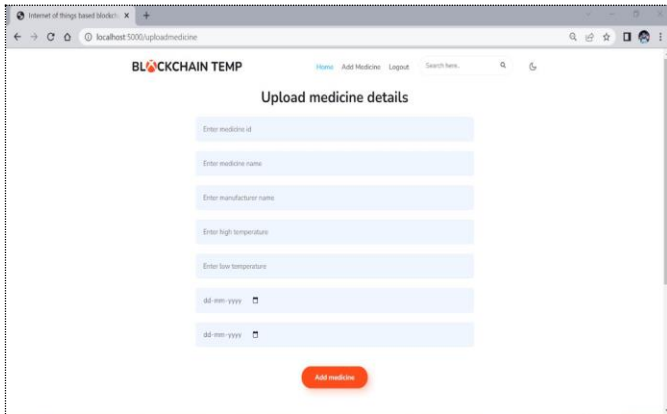

Fig.4. New Medicine Upload Page

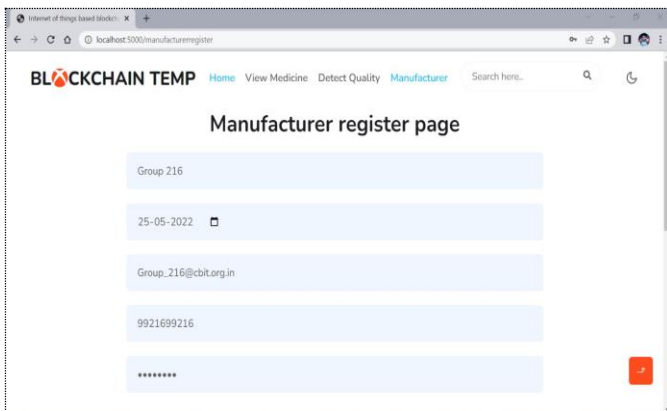Here, the manufacturer uploads every data regarding vaccine its manufacturing date and expiry the medicine id etc.

Fig.5. Manufacture Registration Page

Here the Manufacturer registers to add his vaccine along with the company details etc.
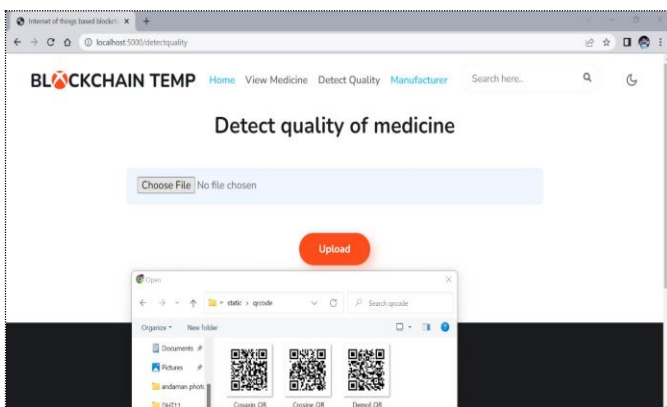

Fig.6. Quality Check Page

When the users enters the page it will display the QR codes along with the vaccine names defined by the manufacturer and user can select the vaccine he wants to quality check and after selecting the file, it will show the QR Code and user can know whether the vaccine is good for use or not.
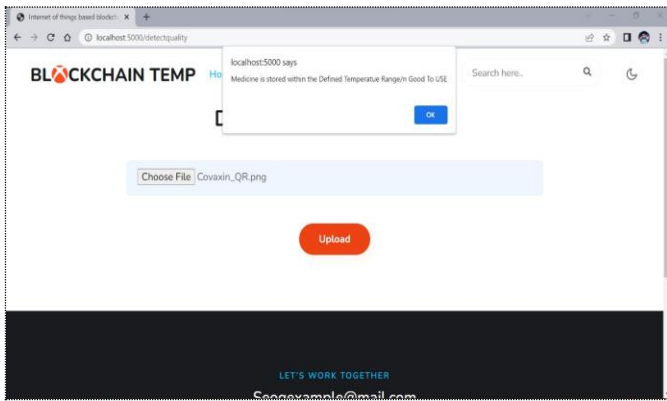
Fig.7. Result Pop-Up after scanning the QR-Code

After selecting the details, a pop up arises which would show whether the vaccine is good to use or not by checking all the smart contract conditions and thus that is how the quality check is done.

4. Conclusion and Future Scope

4.1. Conclusion

We offer a revolutionary blockchain-IoT-based supplier chain management system in this paper to reduce the risk of counterfeit medications and improve the cold chain management of numerous vaccines. We used a blockchain network to implement a QR code system to provide privacy and security to the system. The framework, on the other hand, adjusts to the system's conditions and requirements, and a few components can be adjusted or omitted. Finally, we demonstrate how the manufacturer can upload his drug or vaccine or medicine and how the end user can trace its quality check. Finally, how the quality check was done using temperature monitoring through this paper.

4.2. Future Scope

Complex computing issues afflict blockchain systems frequently. As a result, modular blockchain structures that can provide better and faster services should be constructed. The number of end-to-end and smart gadgets has risen dramatically since the introduction of 5G. This has made blockchain implementation extremely complex, especially in the context of the heterogeneous 5G technology landscape. As a result, enhanced blockchain technology that is secure, secret, transparent, interactive, and consistent is required for 5G. Platforms and technologies such as software-defined networks, cloud computing, and mobile edge computing should be integrated with blockchain architecture. Also, this paper can be employed by implementing our prototype in various other sectors by modifying our prototype. This paper can be scaled to a level that quality check can be done in most of the major sectors in our country.

Consent for publication

Authors declare that they consented for the publication of this research work.

Authors' Contributions

All authors equally contributed in experimentation and paper drafting.

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